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SOME CRITICAL REMARKS ON CAPT. PATTON'S REPORT ON ORIENTAL SORE.

By C. M. WENYON.

[Preliminary Report on an Investigation into the Etiology of Oriental Sore in Cambay, India. Capt. W. S. PATTON, M.B., I.M.S.—Scient. Mems. by Officers of the Med. and San. Dept., Gov. of India. No. 50 (New Series).]

IN this Report the author gives an account of observations made by him in Cambay, India, during the summer of 1910. Many of the observations correspond with those made by the present writer in Bagdad during the same summer, while in other respects the results differ.

Capt. Patton had under observation for three and a half months a case in a boy ten years of age who had a sore of the non-ulcerating type on the lower part of the left thigh. On this case numerous experiments were conducted. It was noticed that the sore occasionally appeared more swollen than usual, and that the parasitic area as determined by puncture of the margin had extended. Parasites were then found not only in the macrophages but also in mononuclear and polynuclear cells. On the first occasion in which this phenomenon was observed two parasites were found in a large mononuclear leucocyte in a drop of blood taken from the upper third of the same thigh. On three other occasions parasites were found in the surface blood taken a considerable distance from the lesion. The author does not state if the blood was taken from the same leg on every occasion. Presumably it was. The observation is an interesting confirmation of Neumann's discovery, made in 1909, of parasites in the peripheral blood in this disease. The present writer made many attempts in Bagdad to discover parasites in the circulating blood both by direct examination and by culture methods, but without success.

Capt. Patton states that the parasites disappear quickly from the sore after it has broken down, and he quotes the history of a sore from which he suffered in support of this contention. He disagrees with Dr. Row, who has stated that the parasites persist in the sore to the very end. The present writer in Bagdad has found that the parasites are much more numerous and easily found in the non-ulcerating sores, but, as Dr. Row has said, parasites persist

even in the ulcerating sores up to or at any rate nearly up to the healing stage. Often a very careful search is necessary, and unless tissue is removed from the base of the ulcer, or preferably through an incision in the non-ulcerating part of the margin, the parasites may not be found. Sometimes, however, the ulcerating sore discharged a fluid not only teeming with bacteria of many kinds but also containing innumerable leishmania.

Capt. Patton criticises the view that the house-fly may be responsible for the transmission of the disease, and for the period of one month he daily attempted to infect scratches on his hand by allowing flies to suck up the parasite-containing exudation from a sore and then to feed upon abrasions on his hand. No sore developed at these places; so he thinks the fly is excluded as a carrier of the disease. He also points out that the people of Cambay are confident that the sore never commences in an abrasion, scratch, or open cut in the skin. Attempts were also made without success to produce a sore by placing some of the discharge containing parasites on the granulations of already existing sores of another kind. It is quite true that most usually the sore commences in healthy skin. Even if a cut or scratch were infected by the transference of a few parasites, the sore would only appear later after the wound had healed. This is the experience of all those who have practised direct inoculation by scarification; but to state that such wounds or sores never become infected requires further proof. I have the history of two Europeans who both contracted sores on the top of an abrasion. In one case an abrasion over the right cheek-bone resulting from a fall from a horse became infected, while in the other case an abrasion over the right shin-bone similarly developed into Oriental Sore.

Capt. Patton's feeding experiments with house-flies led to results similar to those obtained previously by Dr Row and the present writer. The parasites ingested could only be recovered up to six hours after feeding, after which they quickly degenerated and disappeared. There was no indication of a development into flagellate forms. Dr. Row has suggested that the house-fly may take up parasites and later pass them, still in a living condition, in the fæces, and that sores may be infected in this way. There is nothing against such a possibility, though it cannot be accepted till experimentally proved. Alvarez has suggested that fleas may infect dogs with Kala Azar by passing living leishmania in their fæces, and quite recently Nöller has shown that forms of *Trypanosoma lewisi* passed in the fæces by fleas are infective for rats, which naturally become infected with this trypanosome by licking up the forms deposited by the fleas on their skin. Capt. Patton, however, says that in order for the transmission to take place the fly must have a clean alimentary tract. Why this should be necessary is difficult to understand, for certainly the leishmania may live and develop to some extent in association with bacteria. Against the fly hypothesis the author quotes the fact that judging from people who become infected after only a short stay in Cambay, the sores are most commonly contracted, not in the fly season but in the cold weather. In Bagdad, however, I found that though most sores make their first appearance at the beginning of the cool season, indicating that infection has probably taken place during the hot weather, they may appear at any time of the year.

Experiments conducted with *Pediculus vestimenti* and *Pediculus capitis* gave negative results.

With *Stegomyia* sp. Capt. Patton conducted experiments; but though these fed upon the sore, no parasites were discovered in them. With *Stegomyia*

I was more fortunate in Bagdad, for there the mosquito readily took up parasites from the sore and in a certain number of instances these developed into flagellates in the gut of the insect.

No evidence could be obtained as to dogs suffering from the disease in Cambay.

With bed-bugs the results obtained were similar to those obtained previously by me in Bagdad ("Oriental Sore in Bagdad," Parasitology, Oct. 1911). It was found that the parasites taken up by the bugs developed into flagellate forms. The author makes the statement that the parasites ingested by the bug when feeding from the margin of the sore cannot possibly have been dislodged from the sore, but have come from the blood circulating at the spot. The proboscis of the bug is not long enough to reach the parasites. This statement is doubtful, for I have examined sections of excised sores in which the layer of epidermis separating the large macrophages full of parasites from the surface is exceedingly thin, not more than a fraction of a millimetre (about 50 microns) in thickness. It would certainly be possible for bugs to take up parasites through such a layer. Further, the author states that bugs will not feed from the surface of a sore-discharging parasite. In Bagdad I found that bugs would feed fairly readily in this way.

In order to obtain development of the leishmania into flagellate forms Capt. Patton found it necessary to keep the bugs at a suitable temperature, 22°–25° C. He found that at the low temperature of 18°–20° C. the blood in the gut of the bug, and especially of the nymph, remained undigested for a period of 48 hours, and so keeps in good condition for the development of the leishmania. He points out that Oriental Sore only occurs in those parts of India where there is a decided cold season, as, for instance, Karachi, Quetta, Jacobabad, Dera Ismail Khan, Delhi, Lahore, Cambay. As a result he cannot help thinking that there is a factor of fundamental importance underlying the restricted geographical distribution of Oriental Sore in India, and he is convinced that the explanation is to be found in the relation of the temperature to the digestive processes in the bug. In adult bugs only a partial development took place, and the infection was found to die out in about ten days. In the case of the nymphs, however, a much more complete development occurred, and in one instance the author thinks he has seen the post-flagellate stage of the leishmania. It is interesting to note that many of the bugs were fed at a distance from the sores, so that they could only ingest parasites in the circulating blood. On one occasion 100 of such bugs were dissected, and in four of these parasites were found—some in unchanged condition still in leucocytes, and all the intermediate stages showing the formation and extrusion of the flagellum and the multiplication of the resulting flagellates up to the long mature forms. The dissections were made at intervals of one to five days after feeding.

Many attempts were made to transmit the disease by feeding bugs upon cases of the disease in Cambay and afterwards on susceptible persons in Bombay, but without result. Capt. Patton also attempted to transmit the disease from himself to a susceptible person by means of nymphs of the bed-bug, but also with a negative result. From the results obtained he concludes that the nymph of the bed-bug (*Cimex rotundatus*) is the transmitter of the Cambay Sore. He makes many statements in support of this. Firstly, that 95 per cent. of the sores in Cambay are contracted in the cold weather. Secondly, that the bed-bug is the only blood-sucker which will when disturbed commence feeding again a short distance from its

first puncture. This will explain cases of multiple infection. Thirdly, the author states that an insect such as the bug, which is constantly present and returns to suck the blood of the same patient on many consecutive nights, is more likely to take up parasites which only periodically occur in the blood, than an insect such as the mosquito, which hardly ever sucks the blood of the same person on more than two or three occasions. It is difficult to understand the meaning of this statement. The more often any individual insect feeds the more likely it is to take up parasites, but it matters not whether the insect is one that has previously fed on the case or not, so long as it is feeding at the right time, and this must happen as well for the previously fed bed-bug as for the mosquito at its first feed. Fourthly, the author records the histories of two cases in Europeans where the Oriental Sores developed at spots upon which bed-bugs had previously fed. Histories of this nature are interesting, but the present writer collected several such, and it appears that they are hardly reliable though given in all good faith. In the case of three Europeans who developed Oriental Sores in Bagdad or Aleppo a definite history of a mosquito bite (in which the mosquito was actually seen) becoming a typical sore was obtained at first hand from the victims themselves. In another instance a similar history relating to the sand-fly (*Phlebotomus*) was obtained, and in this case leishmania were found in the resulting sore. The author finds that the limitation of the disease to large towns can only be explained by the bed-bug hypothesis, and further that the occurrence of sores almost entirely on exposed surfaces of the body supports his theory, for in his opinion the bed-bug feeds from such surfaces in preference to any covered part of the body.

The author inoculated himself from a sore and developed a typical lesion in which leishmania were found after the short incubation of sixteen days. In another instance a monkey developed a sore in eighteen days; while in another monkey the incubation was two months. This has led the author to the conclusion that the incubation varies with the number of parasites injected.

In conclusion Capt. Patton states that he has no hesitation in saying that the house-flies *Musca nebulo* and *Musca* sp. play no part in the transmission of the disease in Cambay, and that he has no doubt whatever that the bed-bug *Cimex rotundatus* is the only insect transmitter of the disease in Cambay. This may be true of Cambay and other parts of India, but it certainly is not true of Bagdad, as has been pointed out by the present writer in his report on Oriental Sore in this district. However, we must await the conclusive transmission experiments before a definite answer can be given to these questions, and it seems to the present writer that the fact that development into flagellates occurs in the gut of an insect is not sufficient proof of this insect's ability to transmit the disease. Many of the results recorded in this interesting paper agree with those obtained by the writer in Bagdad, whose report Capt. Patton had evidently not seen when he wrote up his results.

